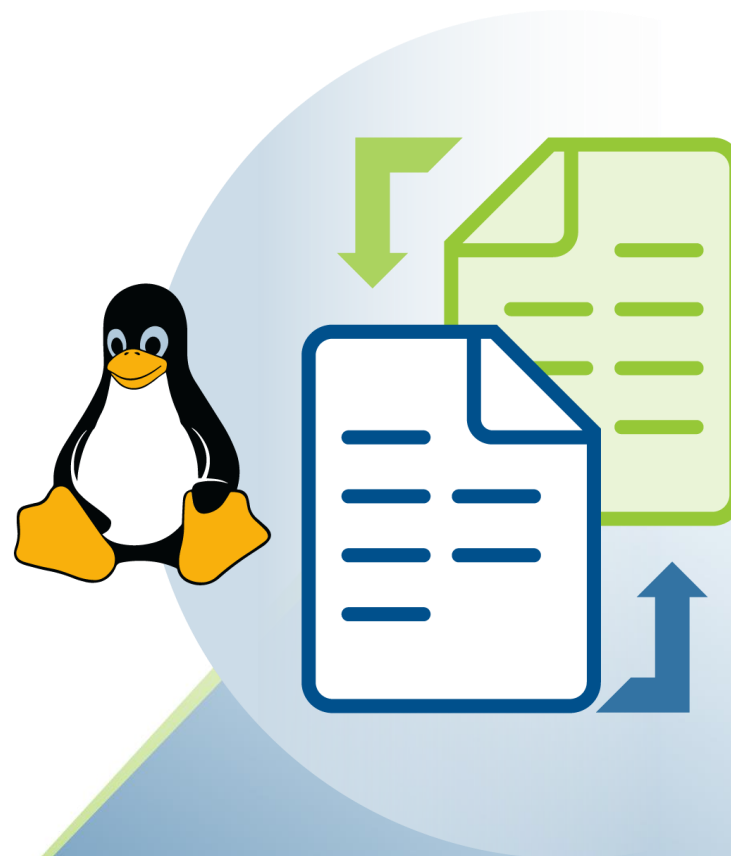


Comparing Linux OS Image Update Models



Presented by
Drew Moseley
Technical Solutions Architect
Toradex



WITH YOU TODAY...



Drew Moseley

Technical Solutions Architect
Toradex

WE'RE LOCATED IN LUCERNE, SWITZERLAND

WHAT WE'LL COVER TODAY...

- Introduction to OTA models
 - Dual A-B
 - OSTree
- Introduction to OTA systems (Mender, SWUpdate, RAUC, Torizon)
- Description of binary delta implementations
- Benchmarking common upgrade use cases





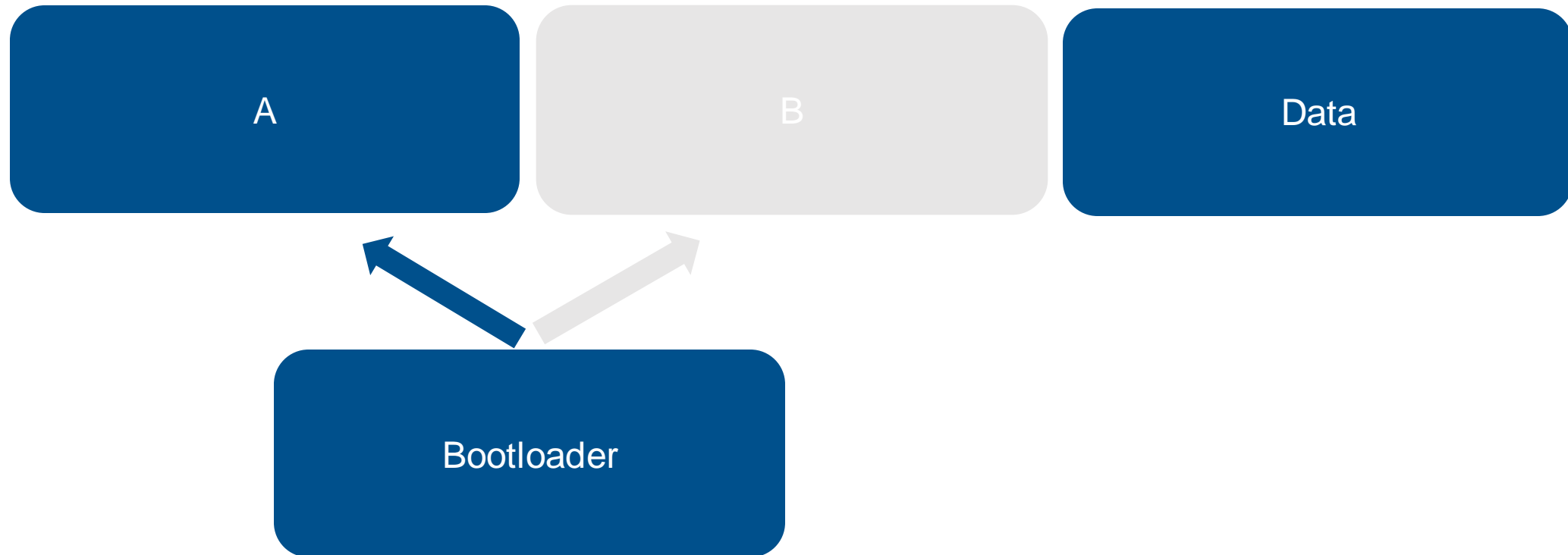
Torizon™

Simplifying the Development and
Operation of Linux IoT Devices

Toradex
Embedded. Computing.



DUAL PARTITION



WHAT IS libostree?

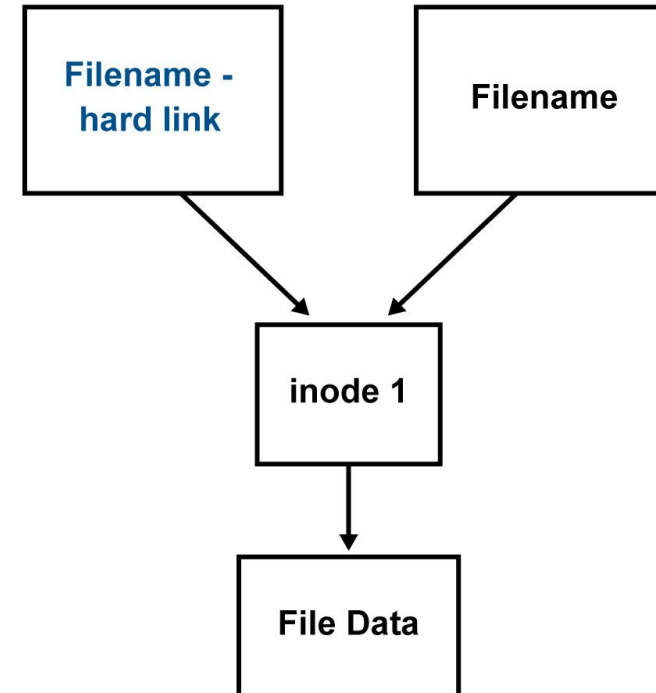
"libostree is both a shared library and suite of command line tools that combines a “git-like” model for committing and downloading bootable filesystem trees, along with a layer for deploying them and managing the bootloader configuration." ¹



¹ <https://github.com/ostreedev/ostree#libostree>

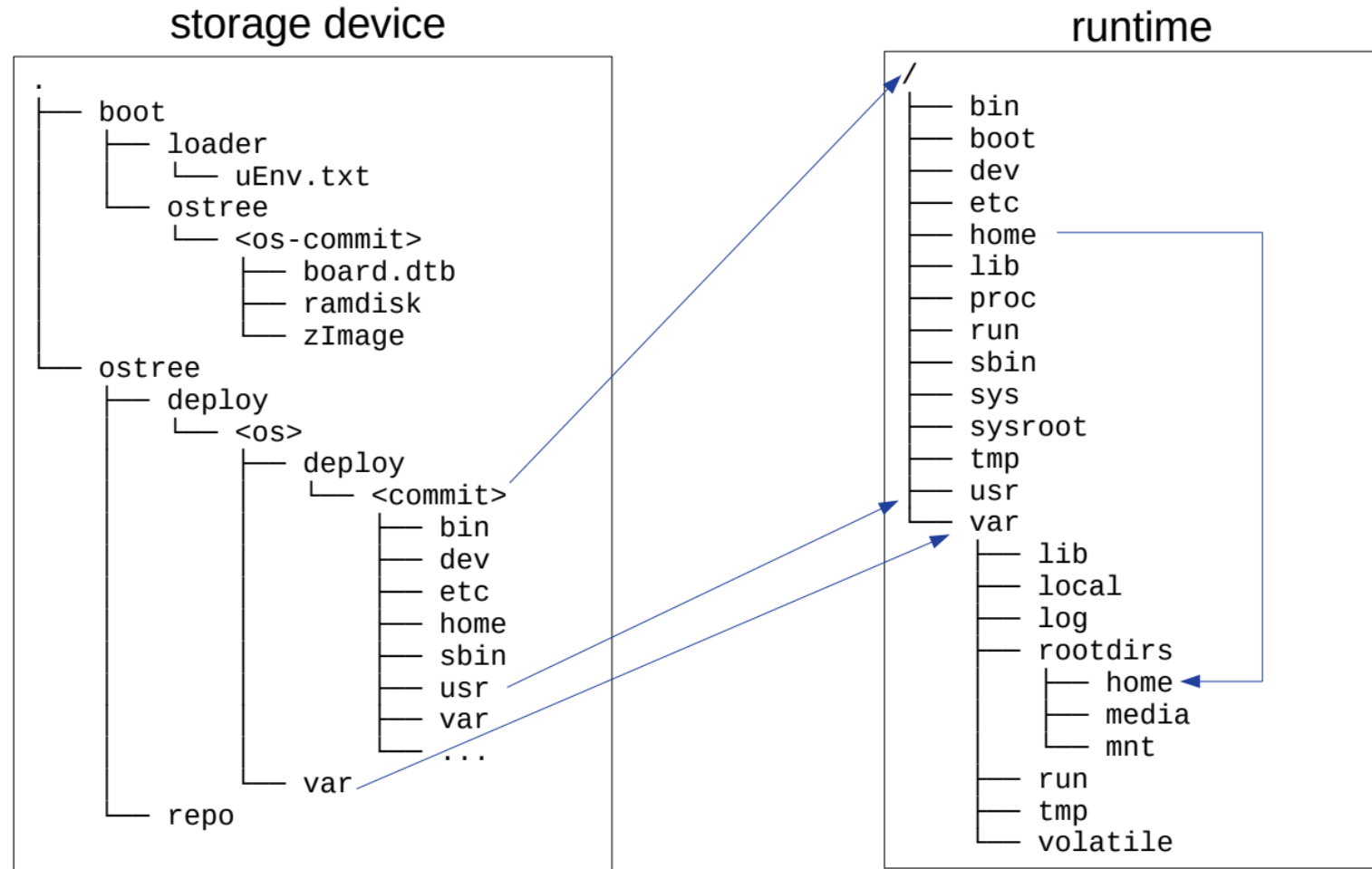
OSTree BASICS

- **File-based (!)**
- **Relies on non-root mount/“bind-mount”**
 - Normally the root of a file system is mounted as “the root”
 - Linux allows to bind mount a subdirectory
- **Initramfs mounts OSTree**
 - Pivot into bind mount/sub-directory
- **Hardlinks are used to speed-up deployment and minimize space usage**



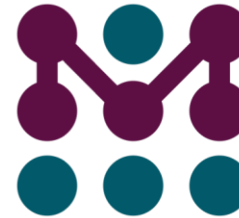
Source: https://medium.com/@1154_75881/what-is-the-difference-between-a-hard-link-and-a-symbolic-link-14db61df7707

Libostree FILESYSTEM LAYOUT (SIMPLIFIED)



Mender

- Dual A-B plus persistent data partition
- Hosted or on-prem server
- Standalone deployments
 - Used for benchmarks
- Binary deltas using xdelta compression tool
 - Part of the commercial offering
 - Read-only unmodified partitions required
 - Default tuning values used for benchmarks



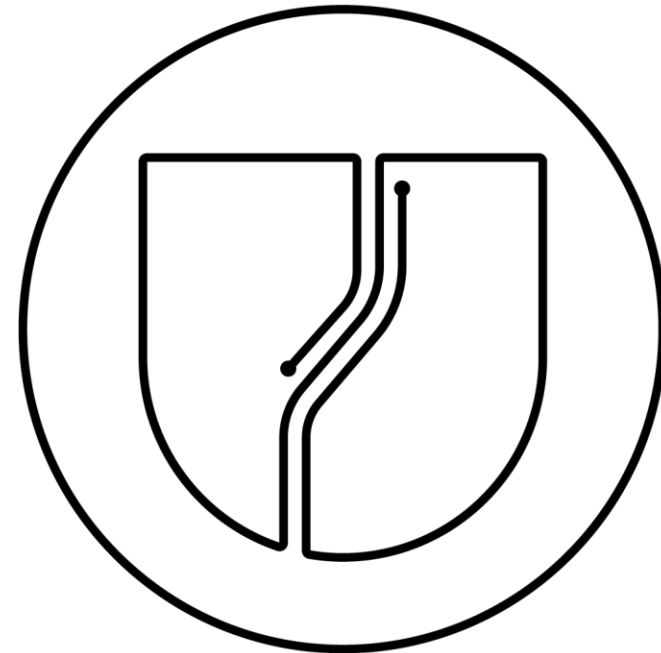
MENDER
by Northern.tech

- Dual A-B plus persistent data partition
- Compatible with Hawkbit deployment server
- Standalone deployments
 - Used for benchmarks
- casync for adaptive updates
 - “Content-addressable data synchronization tool”
 - Can be used on UBI
 - Verity bundle format used for benchmarks
 - Read-only not required
- Block-based adaptive updates
 - 4kiB blocks hashed using SHA256
 - Read-only not required



SWUpdate

- Dual A-B plus persistent data partition
- Asymmetric updates supported
 - Not part of the benchmark
- Compatible with Hawkbit deployment server
- On-device web UI for deployments
 - Used for benchmarks
- Zchunk algorithm used for adaptive updates
 - “A file format designed for highly efficient deltas while maintaining good compression”
 - Read-only not required

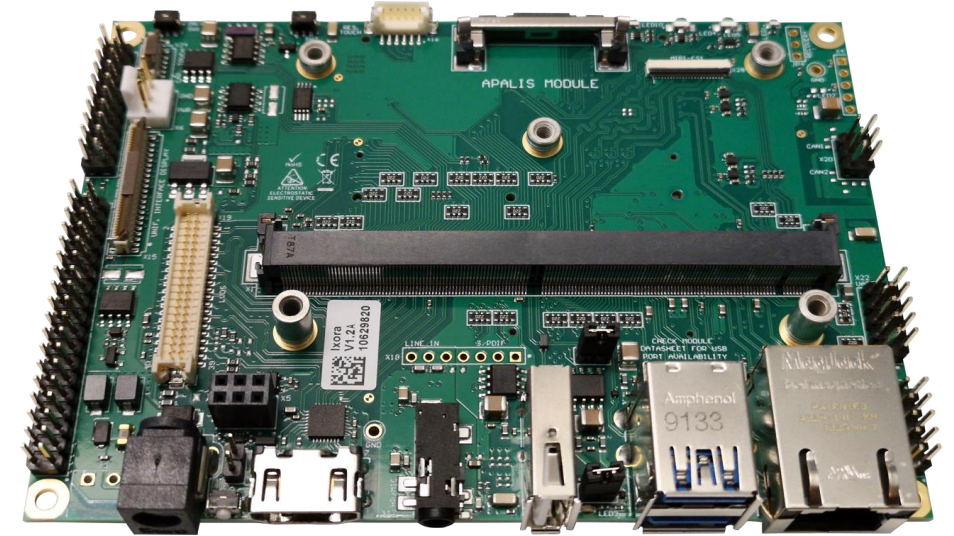
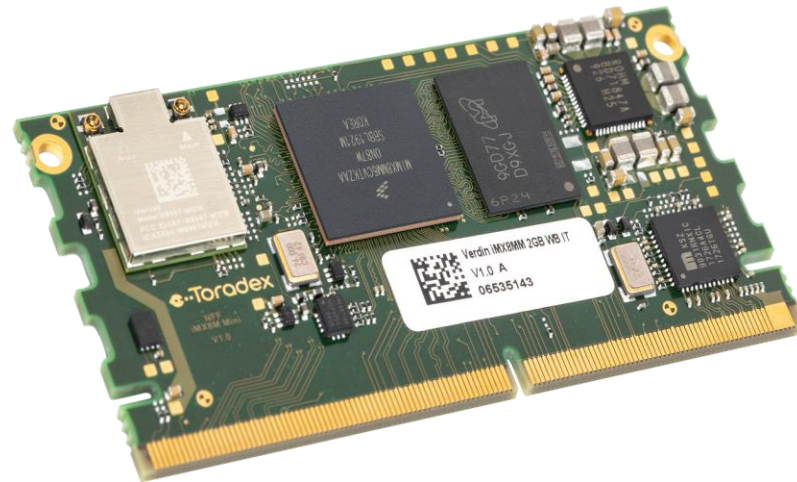


- Single partition managed with libostree
- Torizon cloud deployment server (uptane compliant)
 - Local deployment using treehub is possible
- Read-only required for libostree-managed components
 - /var is completely unmanaged
 - /etc is partially managed (3-way merge)
- Adaptive updates: only new or modified objects need to be downloaded
- Additional size reduction using “OSTree static deltas”
 - Per object binary deltas
 - Significantly reduces the number of HTTP GET requests



HARDWARE

- Toradex Verdin i.MX8M Mini
- Ixora carrier board
- Block based eMMC storage
- Local area network (GbE) for local/standalone deployments
- [Torizon Cloud](#) used for Torizon deployments
- Toradex Easy Installer image used for initial board installation



METHODOLOGY

- Start with standard Torizon repo manifest, Distro, etc
 - Approximately 350MB
- Hack it to allow disabling of OSTree
- Add layers for update systems and chromium
- Implement verdin-imx8mm support on SWUpdate and RAUC
- Build the torizon-minimal image
- Trigger the update
- Use tcpdump and Wireshark to measure the conversation size
- **Overriding Goal:** minimize differences between the setups

Wireshark · Conversations · updater.pcap

Conversation Settings

☐ Name resolution

☐ Absolute start time

☐ Limit to display filter

Copy

Follow Stream...

Graph...

Protocol

☐ Bluetooth

☐ BPv7

☐ DCCP

Filter list for specific type

Help

Close

Ethernet · 2

IPv4 · 1

IPv6

TCP · 1

UDP

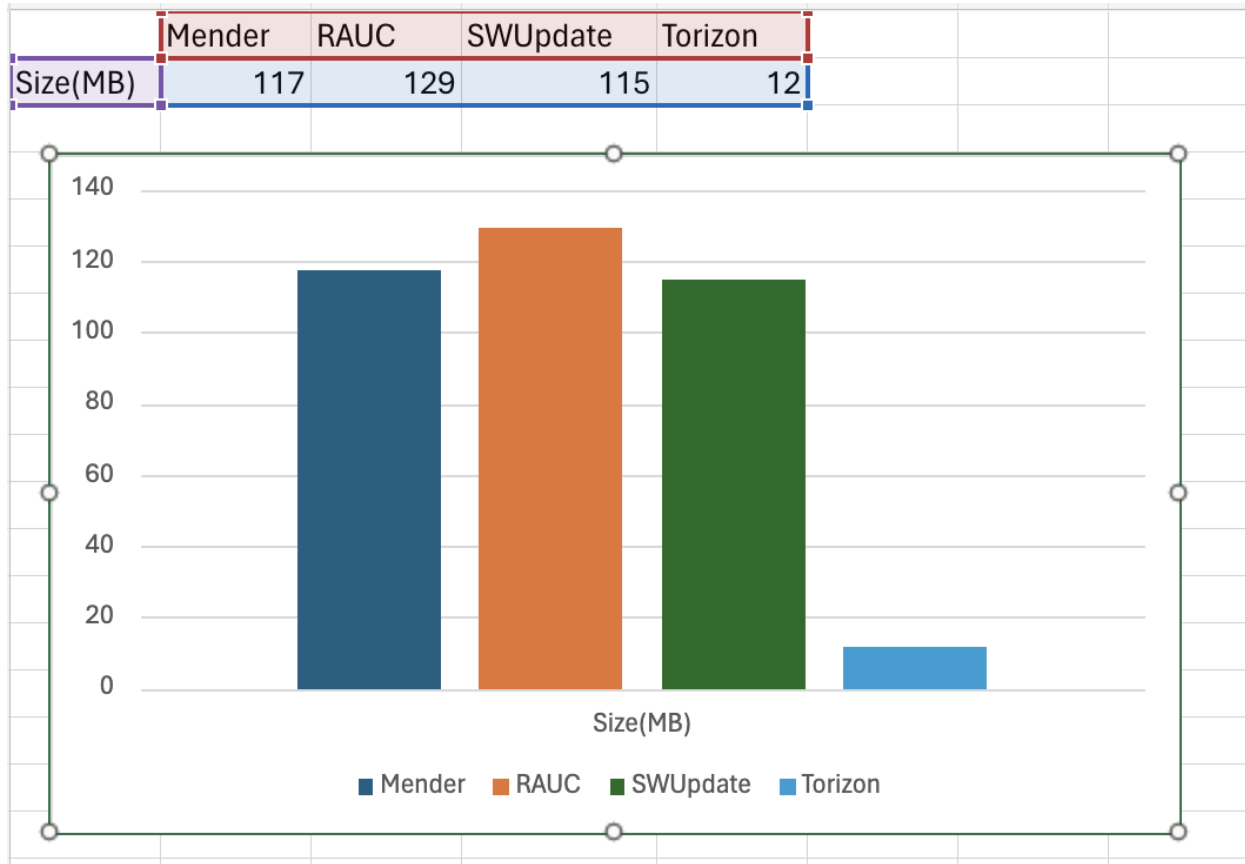
Bytes A → B	Packets B → A	Bytes B → A	Rel Start	Duration	Bits/s A → B	Bits/s B → A
60 bytes	0	0 bytes	0.000000	0.0000		
116 MB	14,977	995 kB	0.000018	20.2904	45 Mbps	392 kbps
		</				

UPGRADE SCENARIOS

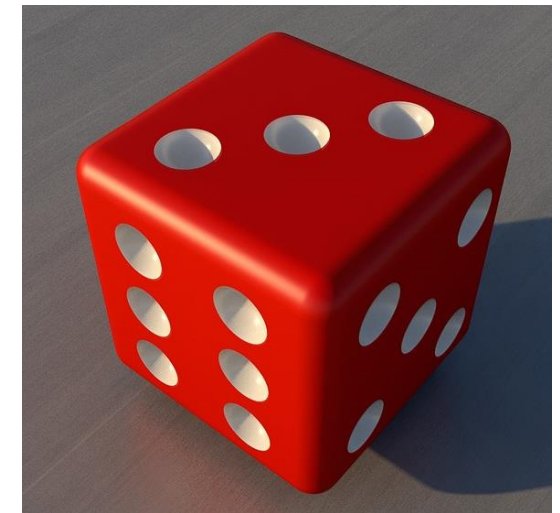
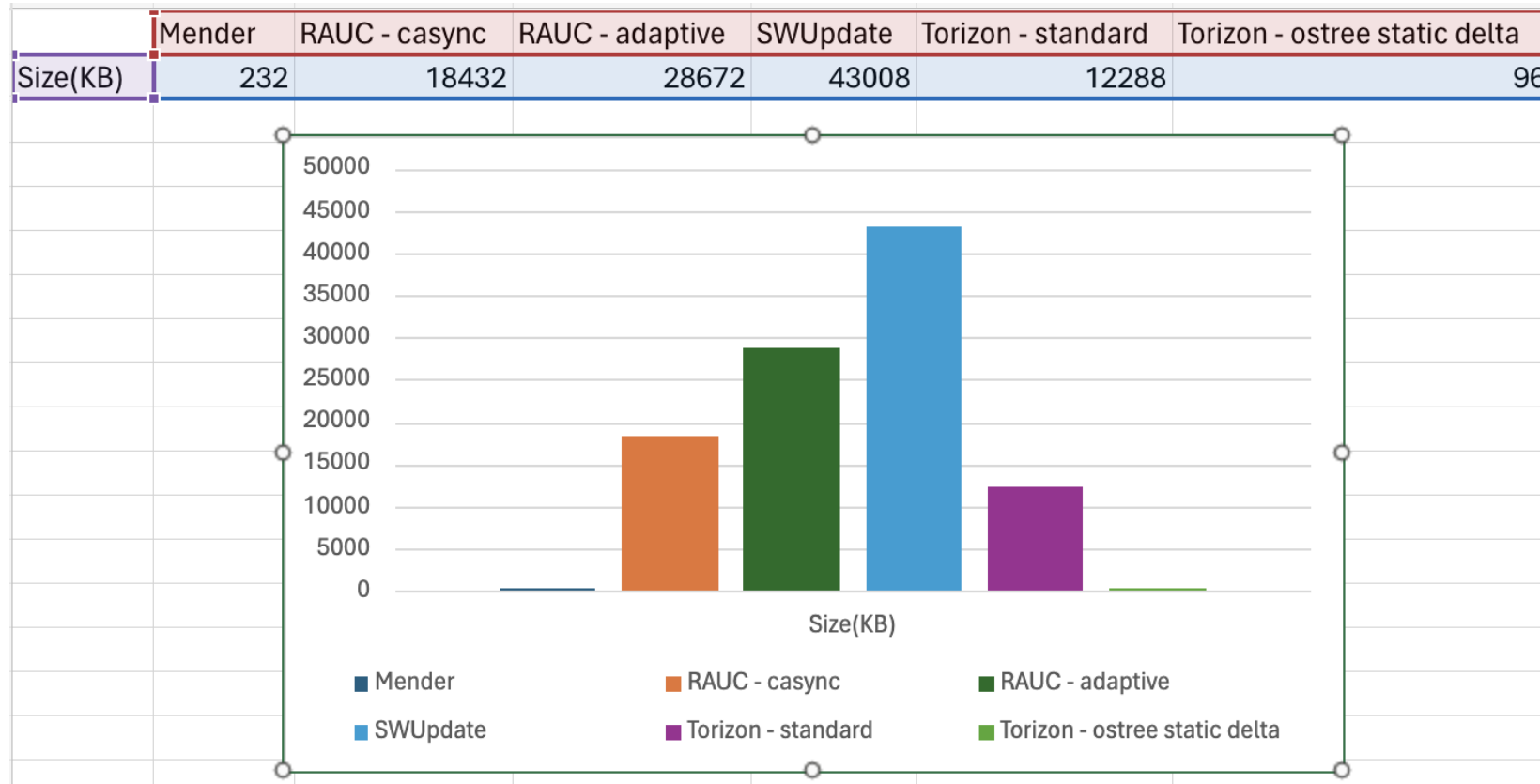


1. Initial install from Torizon v6.2.0 repo manifest using Toradex Easy Installer – no update
2. One byte change in /etc (plus MENDER_ARTIFACT_NAME) - full image update
3. One byte change in /etc (plus MENDER_ARTIFACT_NAME) - delta update(s)
4. Install chromium v100.0.4896.88 - delta update(s)
5. Upgrade chromium to v101.0.4951.54 - delta update(s)
6. Uninstall chromium – delta update(s)
7. Upgrade to Torizon v6.5.0 repo manifest – delta update(s)

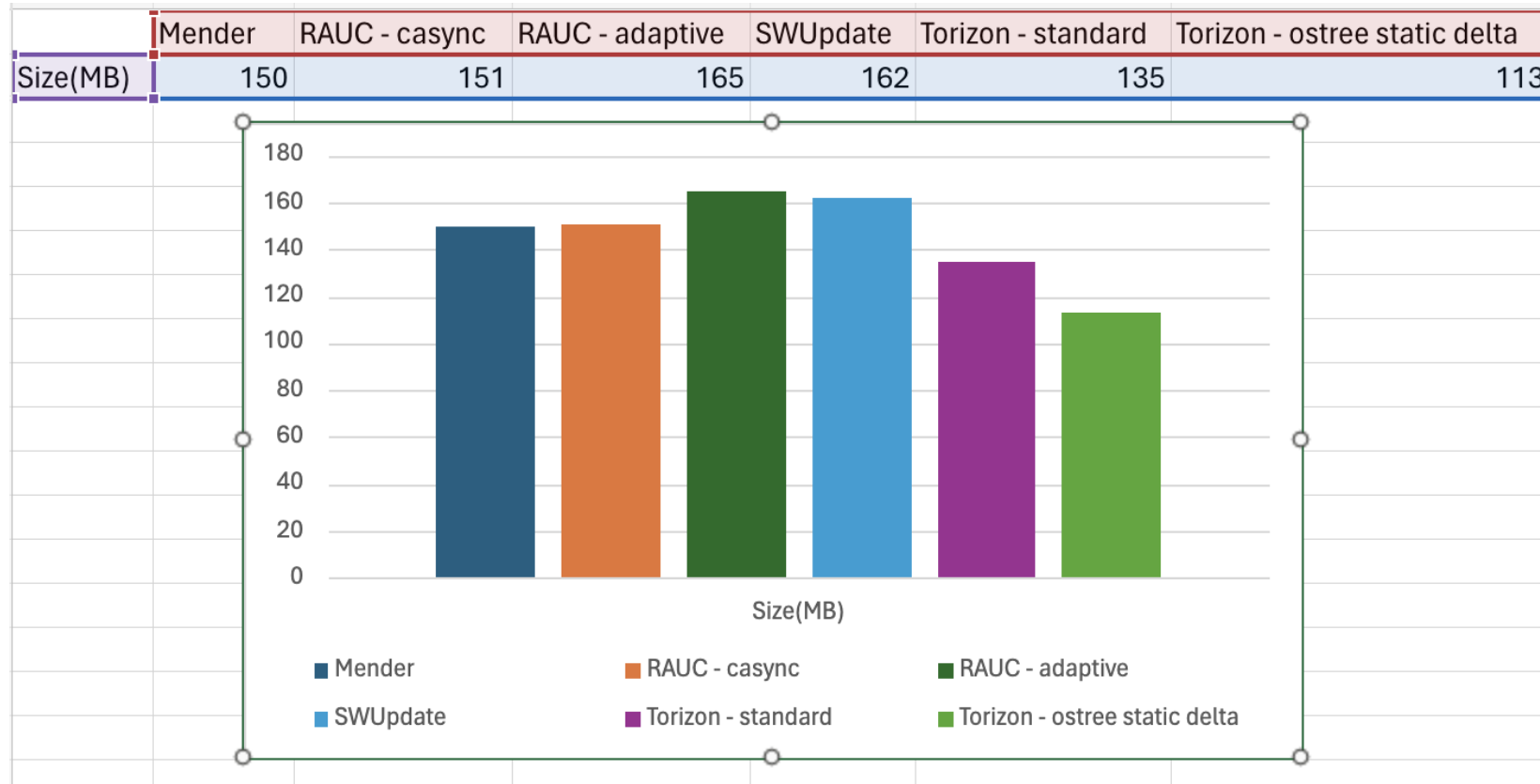
One byte change in /etc (plus MENDER_ARTIFACT_NAME) - full image update



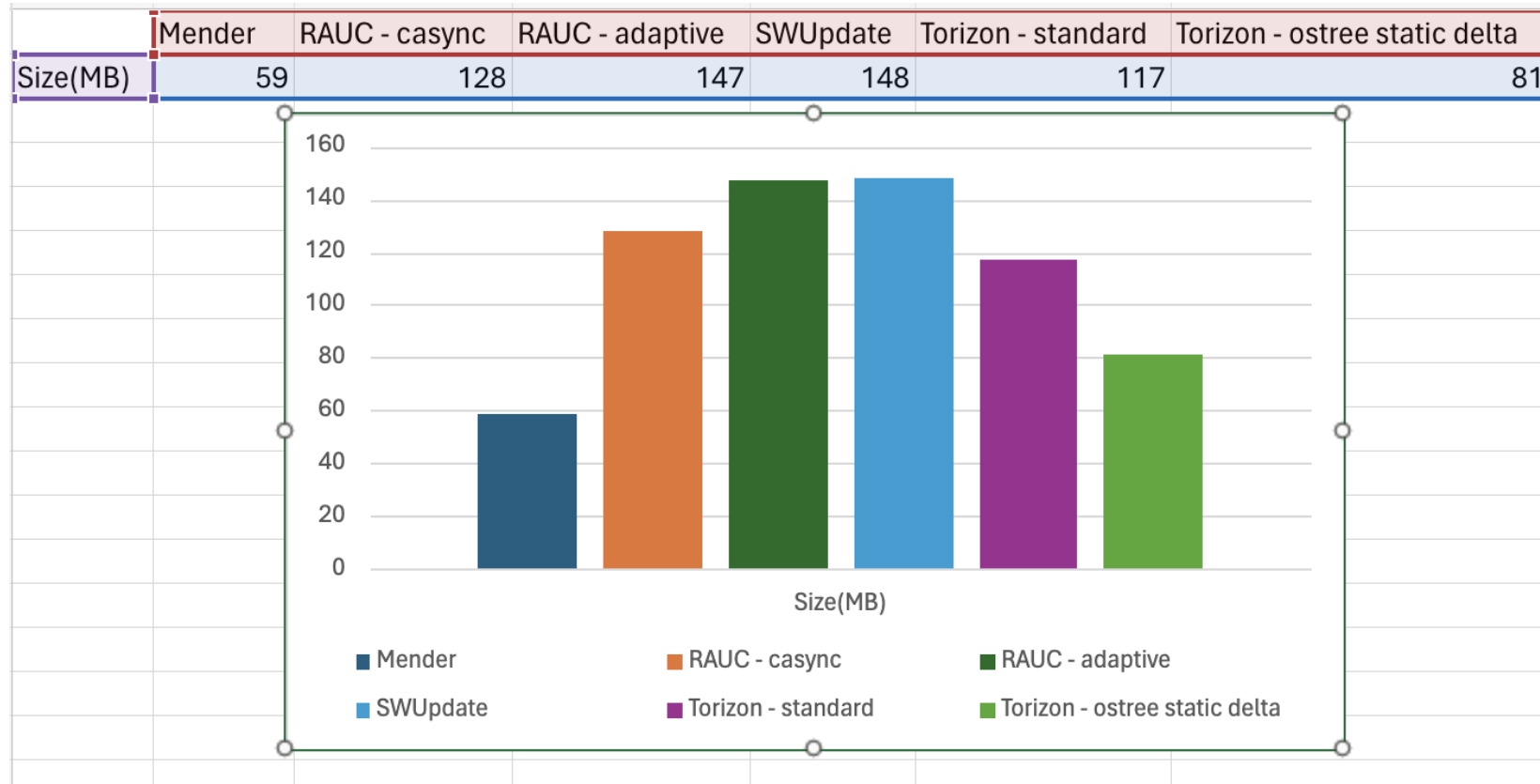
One byte change in /etc (plus MENDER_ARTIFACT_NAME) - delta update(s)



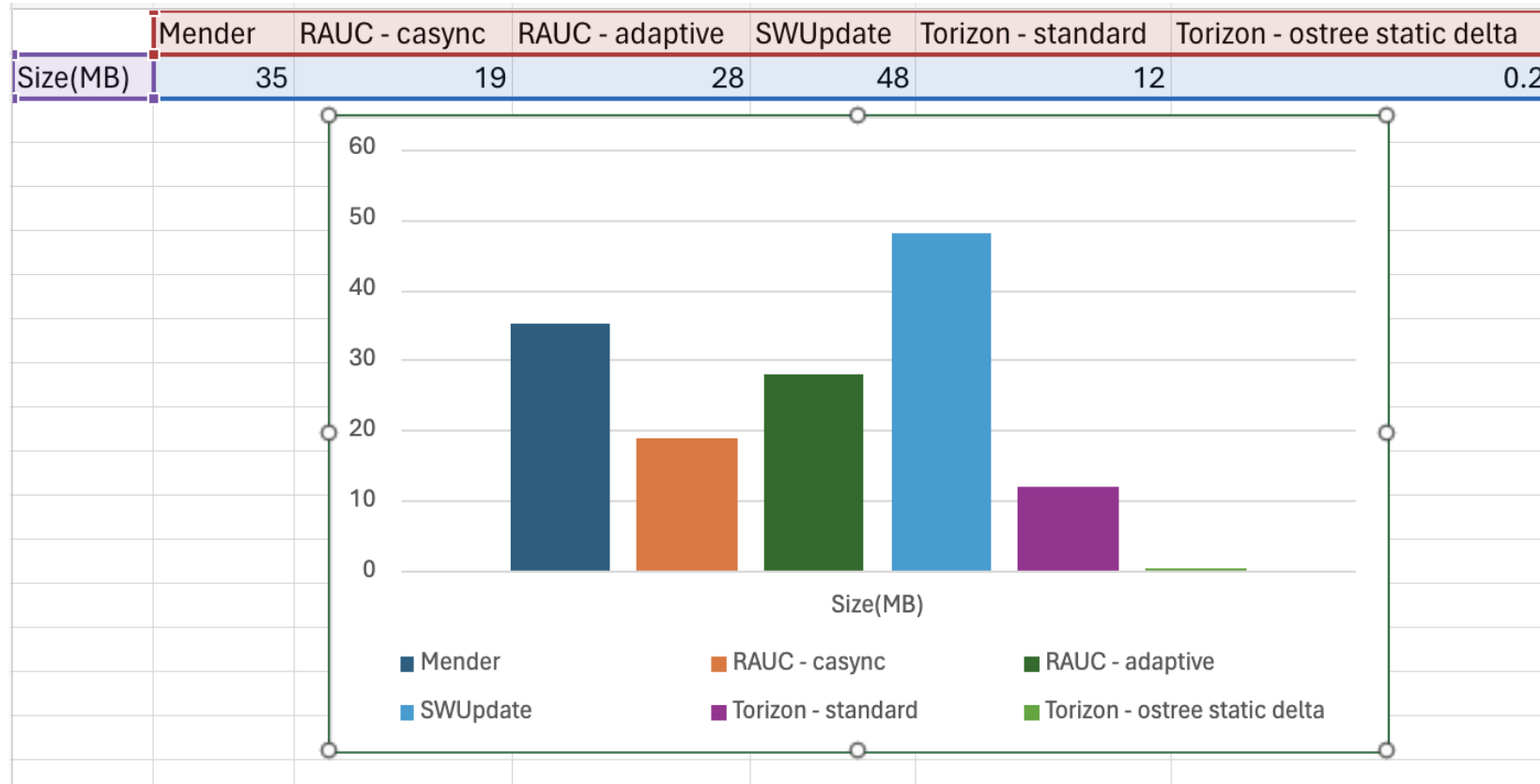
Install chromium v100.0.4896.88 - delta update(s)



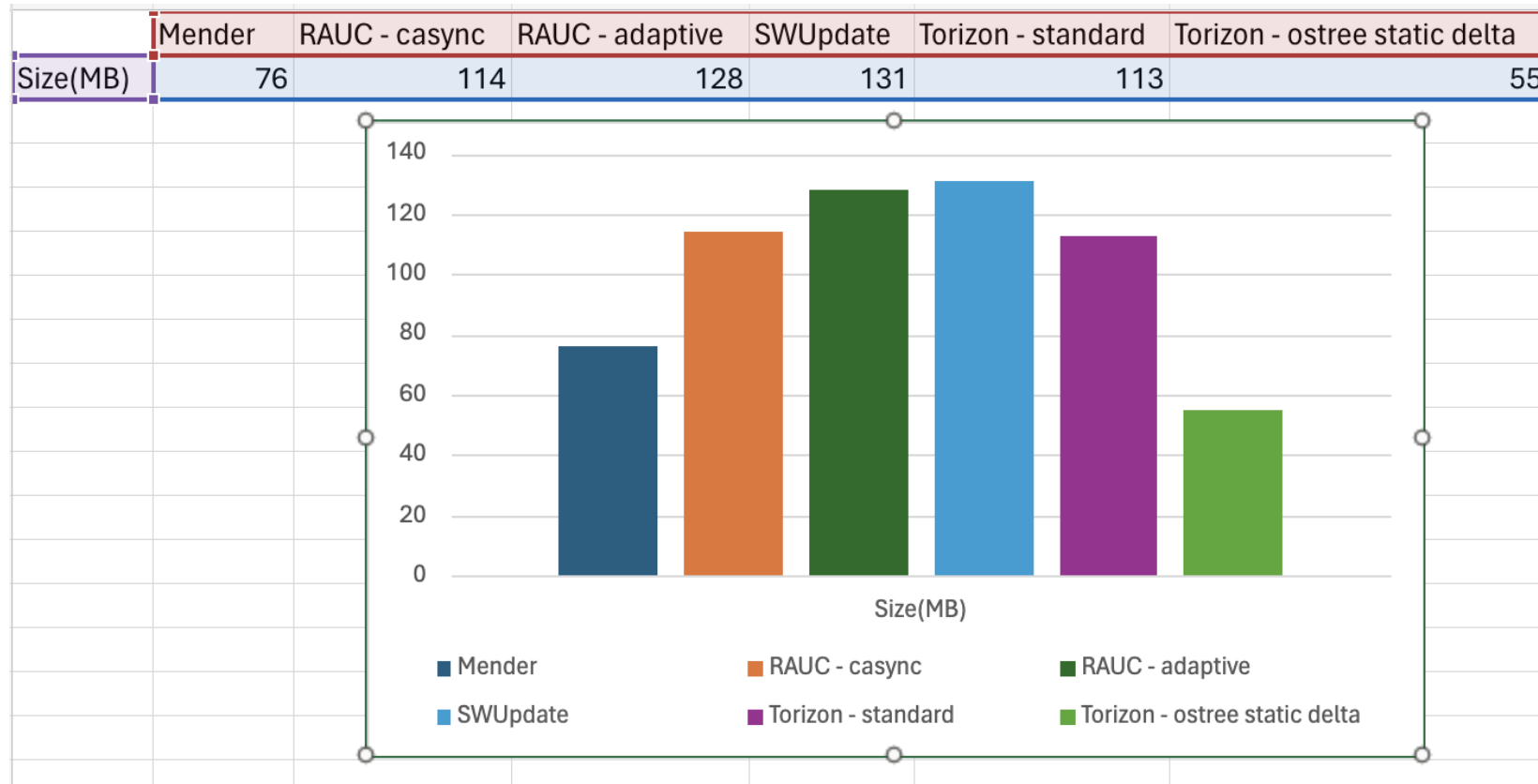
Upgrade chromium to v101.0.4951.54 - delta update(s)



Uninstall chromium – delta update(s)

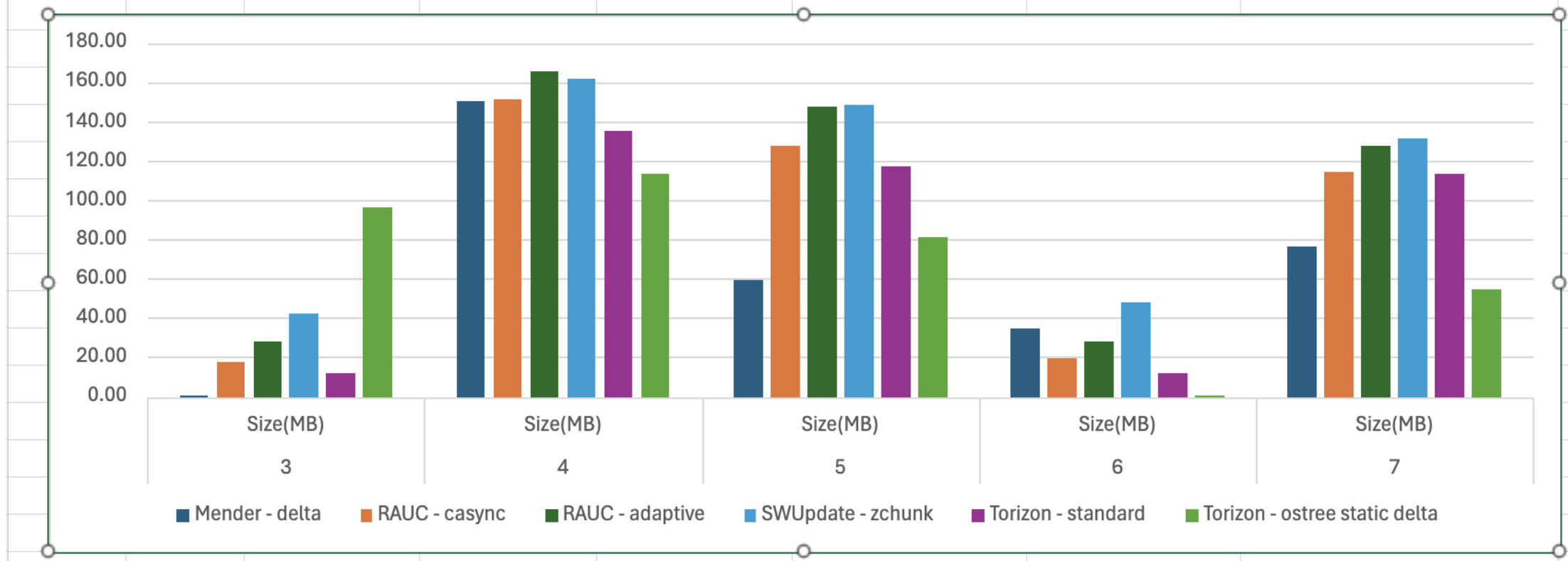


Upgrade to Torizon v6.5.0 repo manifest – delta update(s)



AGGREGATE DATA

Build		Mender - delta	RAUC - casync	RAUC - adaptive	SWUpdate - zchunk	Torizon - standard	Torizon - ostree static delta
3	Size(MB)	0.23	18.00	28.00	42.00	12.00	96.00
4	Size(MB)	150.00	151.00	165.00	162.00	135.00	113.00
5	Size(MB)	59.00	128.00	147.00	148.00	117.00	81.00
6	Size(MB)	35.00	19.00	28.00	48.00	12.00	0.20
7	Size(MB)	76.00	114.00	128.00	131.00	113.00	55.00



NEXT STEPS

- Clean up and submit board support (?)
- Setup a Kas configuration for repeatability
- Blog write up – including update times
- Google Summer of Code projects for Uptane enhancements
- Other interesting update scenarios



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Q&A





**THANK YOU
FOR YOUR INTEREST**

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Arm® System on Modules

